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**A REVIEW OF THE FOUNDRY LITERATURE
OF THE MONTH.**

AMERICAN MACHINIST.

The issue of August 12 contains an illustrated description of the foundry plant, lately erected by the Chattanooga Foundry & Pipe Works, Chattanooga, Tenn.

This journal publishes in the same number a paper read by Gus. C. Henning before the Hartford meeting of the American Society of Mechanical Engineers, entitled "Casting Gears in Baked Molds." The paper describes, what is claimed to be, an improved method of obtaining gears that are approximately true, which, as everyone knows, is very difficult in ordinary molding. We give the text below:

"I think a word ought to be said in favor of cast gears, if they are made in the proper manner. As cast gears are generally made, when hot metal is poured in, the result is anything or nothing—cracked gear or anything else. The strength of such gears cannot be determined except accidentally. But there is a way of making cast gears so that they will be nearly as good as the best cut gears, and it is a very simple way. Take a cut pattern and mold it up in a material that will bake pretty hard; then leave the

gear right in the mold, and put the whole flask and pattern in the core oven and bake it. The result will be that, as clay or sand expands less than metal, the expanding metal pattern will crowd the sand so that upon cooling, the pattern will lie loose in the mold, and it can be taken right out. The cope is then put on, and before the flask is cold the metal is poured into the mold, which is free from dirt or dust. The dust can be blown out with a blower if it is necessary, but there really is not sufficient dust in the mold to hurt the casting. The metal is put into the hot mold, and the result will be a gear which is sufficiently good to run in a printing press without any noise. These gears are used on printing presses, and people who use them do not know that they are not cut gears, because if the cut gear used as a pattern has the slightest tool mark on it those tool marks will appear in the casting. Such gears are used at the present time. I think the patent on this method expired long ago. Such gears are strong. As the mold is hot when the metal is poured in, the shrinking or cooling strains are less, and the metal is not chilled so rapidly when it reaches the mold. It is, of course, chilled, but not so fast; and, besides, the hot flask, with all the material in it, helps to anneal the iron during the cooling process, so that an almost uniform condition of metal is obtained in the gear. In ordinary cast gears there may be anything but a true gear. There are shrinking and cooling strains, possibly a bad core, slight cracks in the corners, even though they are not true shrinkage cracks; there are surface shrinkage cracks which are, I think, generally disregarded, but they are of importance in considering the strength of a gear. Some loose material will perhaps get in the surface of the gear, as soon as the metal begins to wear down it will wear badly. There are other reasons why an ordinary cast gear is never as strong as the formula indicates; and all formulas, except when applied to cut gear or annealed gear, should be empirical rather than rational, for the reason that the factor of uncertainty cannot be readily applied to a mathematical—a rational—formula any easier than determining a few strengths of different gear empirically, and then using a formula constructed on those results as a

basis. But the method which I have described will give satisfactory results, and can be used for large and small gears with equal facility. These gear patterns require no taper, because the metal expands very much more than the surrounding material, and they can easily be lifted out without any trouble whatever, and the material surrounding the pattern being baked hard, of course, has considerable strength, especially when the sand has been saturated with some baking material or substance. There will be no difficulty whatever in doing that, and a gear will be obtained which is equally strong in all parts and one which operates with uniformity. Anyone who has seen printing presses run knows how perfect these gears must be in order to run smoothly for long periods of time without the slightest interruption.

"I know of gears 48 inches in diameter having been cast that way, which ran perfectly, and the pitch line did not change, because when the material begins to cool down sufficiently to be a solid mass the clay or sand begins to cool off with it and the two go together. In the first place, the pitch diameter was changed by the expansion of the gear in the mold; but originally that clay was tight to the wheel, and, on the other hand, the molten metal coming in will shrink a little more than the mold will afterwards, so practically they are the same thing. The gears cannot be heard when running, any more than cut gears. If that is true, the gears must certainly be run together so nicely that the variation of pitch diameter is immaterial. They can be seen running on all of the new presses of the Walter Scott Company, in Plainfield, N. J. They are putting them on all presses now, since about two years, and no one knows that they are using cast gears instead of cut gears, because they give the same satisfaction. They are experimenting now on larger gears.

"They do not pay much attention to that (the shape of the flask, in reply to a suggestion that round flasks would be more suitable than square ones), because there is always so much packing material around the pattern. I believe they are guided by the size of the core oven. If they can get the flask in the oven, they take one of that size."

August 19.—John M. Richardson contributes an article on "Selecting Pine for Pattern Making," which, as its title indicates, gives advice as to suitable selection and care of pattern lumber. He says: "This wood stands at the head for patterns, being employed universally for all sizes. Of course cherry and mahogany are better; but owing to their comparative cost, are used only in a limited way on quite small work, and for trimming exposed parts of larger standard patterns which are in constant use. Pine is soft and easy to fashion into any shape with edge tools. It is light, and does not have that open, coarse grain that chestnut, ash, oak, and some other woods have, and while it is soft, still it is not brittle and liable to easily chip and splinter on exposed parts. Again, it does not have that wonderful tendency to curl and twist, as for instance does white wood. Ordinarily the grain of pine is straight, and it can be planed with satisfaction. This is a feature of no small moment; for what is more exasperating than to try to plane a piece of wood like *lignum-vitæ*, where the grain runs in narrow stripes, as the plane slides along, every alternate stripe being as smooth and shining as glass, while the intermediate ones are very much the reverse; then when we turn the piece around and plane in the opposite direction we get a result exactly vice versa, the rough stripes being smooth, and the smooth ones rough. Every wood has its place, fortunately, and *lignum vitæ* works beautifully in the lathe. Another reason which brings pine into favor, and perhaps it is the mightiest of them all, is that it is cheap and plenty. No one can tell any quicker at sight how a given board will work under the tools than the pattern maker who must use it. For this very reason the selection of pattern stock should be entrusted to an experienced person and not left to the tender mercies of the help in the lumber yard. There are certain undesirable qualities in some pine, which we do not want for pattern work, and which can be, for the most part, avoided by a little care; but it is very difficult to do this when the board is rough before being planed at the mill. It is better, I think, to buy the stock planed, for one can then see what he is getting. A shaky piece is to be avoided as useless. This is where the grain

seems to be cracked and slivered lengthwise of the board. It is claimed by some to be caused by the wind straining the tree, and sometimes by the way the tree falls when it is felled. I am not an authority as to the cause, however, but realize fully the undesirable effect. Knots are an objection which is self-evident, and can be easily avoided, because in plain sight. What is termed sap wood is undesirable also. This is found toward the outside of the tree, next to the bark, and sometimes an outer board near where the slab was removed, will show sap pretty nearly all over one side, and show scarcely any on the other, except at the edges. Many good boards are sappy at the edges. This is probably the least of the undesirable qualities, and is shown by the color which is usually almost white, although sometimes of a darker shade. In these places the wood seems lifeless and spongy, and is very difficult to work smooth with the tools. A soft board which works easily is very light, and one would not associate the word pitch with it in any sense. It is also lighter in color, while a hard piece is much heavier, and traces of pitch being clearly seen, while the whole is more yellow in color. A hard piece works very much the nicest in the lathe, and will turn up very smooth indeed, but is not so pleasant to use with hand tools. Above all things get dry lumber, for no matter how perfect the quality, if not properly seasoned and dried, it will shrink and crack, and cause no end of trouble and spoil the finest of patterns. Many patternmakers prefer season dried stock to kiln dried. This is open to opinion like other things, but it must be thoroughly dried in some way. When a piece of plank is sawed off it will check at the freshly sawed ends after a time if not properly dried. If it shows any inclination at all to check at the ends, it is not properly seasoned, and not fit to find a place in a pattern. In storing away lumber for use, it is bad practice to pile boards flat, one above the other, for this allows no circulation of air between. Either pile edgewise, or flat, with narrow splines placed at intervals between. Some pine shows curious short curved streaks which seem to bear some analogy to the marks in quartered oak. If anything, these marks are a little harder than the surrounding wood, and

are frequently found in the best lumber and a board having them is not therefore necessarily to be avoided; but the ideal stock for a pattern is light, soft and straight grained, free from all knots, sap, or any irregular markings whatever, and last, but not least, dry, and this last to be emphasized."

James F. Hobart writes a short sketch on "Daubing Up a Cupola Taphole."

H. O'Neil asks the question, "Is the Average Molder to Blame for What He Don't Know?" and calls attention to the fact that with our present subdivision of molders, a large number are kept constantly on the lowest class of work, and that their limited experience prevents them from becoming better mechanics.

Thos. Wathey describes a method of making cast iron gaggers in a chilled mold, which can be used continuously, instead of the common sand mold.

THE FOUNDRY.

Touching upon the inclination of some shops to get along with nothing this journal says, under the caption of "Making Things Do":

"The man who is handy in getting around troubles and who makes a specific study of overcoming everyday problems arising in the shop by contriving some makeshift for this purpose is sometimes given more credit than he is entitled to. The man who can turn out good work in a second class shop with third rate tools and appliances may be a genius, but this need not necessarily imply that he is a paying investment on that account. It may pay to do things this way once, but when it comes to repeating it in succession the man with tools that will fit the job is going to win the day.

"Too much credit has been accorded the man who can run a foundry with nothing. Like the molder who can do any job with a trowel and a tenpenny nail, nobody has taken the trouble to figure out what it costs to get along with a poor equipment and wind for a motive power.

"The foundry foreman who can run a ten-ton heat from a five-ton cupola, hoist an eight-ton casting with a three-ton crane and

make a stack of old flasks do for all different kinds of jobs may be handy and the proper person on some occasions, but when it comes to saying that his ability in this respect is a passport to economical production we are placing ourselves on the other side of the fence where there is room for argument.

"Kinks and makeshifts have their place only so long as they are profitable. When your competitors make a rigging that will fit the job, all your efforts to make things, that you have on hand, do, is going to carry you so much nearer the pool of bankruptcy. The handy man was a great convenience, so long as nobody undertook to bid against him, but his day in American foundries, except in isolated localities, is gone. He has been counted out in the cold figures of dollars and cents as the imperfect machine has been superseded by something better. He was handy, it is true, but this did not count against perfection. He could turn out a job where managers of to-day could not make a beginning, but the cost of doing so exceeded that of the man who made provision to get around difficulties. He was handy, but not economical. It is not business to get along with nothing."

Henry Hansen describes a visit he made to the Bryant Iron Works at Buffalo, N. Y., and the evident completeness of the molding machine, which this firm is manufacturing.

S. S. Knight contributes a paper on "Fletcher's Process." This paper is an enlargement upon a similar paper presented before the Foundrymen's Association in Philadelphia by the author. It describes one of the latest inventions in the pipe foundry illustrated with two half-tone engravings taken directly from photographs of the machine. This method of making cores can be used in many other places besides pipe foundries, in fact, any place where loam cores are swept up on barrels. With hay rope, a six inch core costs about five cents, while with the new process the cost is less than one cent, besides insuring against defects common to the old method.

The following is taken from Mr. Knight's description:

* * * "The method for using this process is very simple and extraordinarily adapted to the capacity of the average foundry."

dry laborer or pit man. In place of the hay rope ordinarily used a coating of sawdust, which has been previously mixed to a paste with a 2 per cent solution of hydrated starch is applied to the exterior surface of the core-bar or barrel by means of an open meshed web which passes from one roller under the core bar and on to another roll of the same size on the opposite side; motion is given to the two rolls and bar which are directly connected together by means of spur cogs, by a crank, while at the same time the rolls are turned the material is fed in from above from a hopper which is slightly inclined away from the roll so that the hydrated starch solution will not run out and thus leave the sawdust dry. A single turn of the bar suffices to give it a firm coating of sawdust from which the starch solution is largely squeezed out, and which when dried in the oven furnishes a solid foundation upon which to place the last and only coat of core dirt which is the same thickness as the finishing coat now so generally in use. In actual practice it has been found to be by far the most economical way to make the before mentioned starch solution, by either using a submerged steam coil in a tank of water, or by injecting live steam directly from an open pipe; if the latter method is used the amount of condensation which takes place from the injected steam must be taken into account or else the solution will be too weak to render efficient service. From one hydrating tank situated in a convenient part of the foundry a one-inch pipe may be run to any core board desired, and thus the sawdust and hydrated starch mixed only as it is needed. It has been found that if the solution is allowed to stand over 24 hours it greatly deteriorates, due to the action of bacteria upon the starch itself. It is easy to judge, however, how much solution will be required for a day's work and the supply regulated accordingly, but if too much has been made it may be kept an indefinite time by adding two ten thousandths of 1 per cent of formaldehyde, which may be procured from any manufacturing chemist for \$1 or less per pound.

"Since it is necessary to have on small cores a layer of combustible matter of only a quarter-inch or less, it will at once be

seen that a correspondingly larger size bar may be used, than with the old process; this not only facilitates the putting up of cores and increases the percentage of good pipe obtained, but also materially prolongs the life of the bar. Anyone familiar with pipe foundry work must have noticed the corrugations which are so plainly discernible on the inside of many of the larger size pipe, and which were caused by the partial burning of the hay rope, while the first coat was being dried in the oven; it will also be noticed that such corrugations are impossible with this new method, since a solid coating of combustible material is applied. If too hot a fire is used in drying of course the sawdust will burn off the same as hay rope will, but this advantage will be noted over the hay rope process—that if such is the case it can at once be seen since the sawdust coating is not covered with clay or mud while the hay rope must of necessity be inaccessible.

“The number of bars which stick or refuse to be drawn due to the mud which reaches the bar through the spaces between the turns of hay rope, every one connected with a pipe foundry must have noticed. This occurrence is absolutely precluded by the use of this new process since a uniform coat is applied to the entire exterior of the bar. One other feature which should not be overlooked is the facility with which pipe made by this process may be cleaned, since no clay is used in the core dirt; in fact, where now so much cutting and chipping are required to free the pipe from dirt, the dirt used by the process may be washed out by a strong jet of water under high pressure, or by simply rapping the pipe with hammers.” * * *

THE TRADESMAN.

In writing of “Quality of Work and Wages” E. H. Putnam says:

“The workman who argues that because he receives a low price for his work, therefore he need not be particular as to its quality, makes a very grave mistake. This is pretty hard for him to believe; but let us look at the question dispassionately for a moment. The conduct of foundries is largely in the care of

superintendents and foremen, who are not members of the firms. They are of course presumed to use the greatest possible economy of labor and material, and therefore at the end of the year, if there be no profit, the employer will naturally look to reduction of wages as the only possible means of remedy. How can it be otherwise? He cannot control the market price of materials; the management and economies of the factory have been as good as himself and his assistants have been capable of; and there have been no profits. Obviously his only recourse is to reduce wages—for nobody will be so ignorant of economic law as to suppose that he can increase the selling price of his product. Men will not long continue to do business at a loss. You and I, employer or employe, no matter which, will get something for our time or capital if it lies in our power to do so.

"And it behooves the workmen of every factory to strive to return a profit to the employer at current prices if possible. In figuring the cost of foundry product, we say, so much for iron, so much for fuel, so much for molding, so much for common labor, such per cent. for running expense, such per cent. for deterioration, etc. It is plain that if the laborer 'kills time' he thereby adds to that item of cost. And if the molder loses work or makes bad work that has to be rejected, though he may get no pay for the molding, if a piece workman, yet he thereby adds to the cost of material, iron, coke, wood, clay, firebrick, labor in handling, per cent. of running expense, per cent. of deterioration, etc. And the more there is of dishonest and inefficient work, the greater will be these items of expense, and as a necessary consequence, the less will be the profits."

The same writer says of the Doherty Process and some of the claims made for it:

"One large company of the United States avers that it saves \$4 per ton. A pretty round profit in itself! It is also claimed that the process produces much softer, stronger castings. Also 'all castings are perfect, being very smooth and even!' How difficult it is to induce operators to adopt new methods! Now, here is a chance to save about half the price of a ton of iron per ton, and

at the same time you get castings that are all perfect, smooth and even, much softer and stronger, produced more rapidly, easily and surely.

"I don't know a thing about this process except what the pamphlet says. It says that the process is in importance equal to that of the Bessemer process in steel making. That is true—if it will do what is claimed for it. Nay, if it will do one-half, or one-fourth even, of what is claimed for it, it should be employed in every foundry throughout the world.

"The chief trouble with new 'tricks' generally is that so much is claimed for them that the 'old dogs' either can't or won't learn them, for most of the foundries are in charge of the 'old dogs,' whether foremen or owners, and the owners are generally as "doggoned old dogs" as the foremen, when it comes to experimenting.

"I do not say that the process under discussion is less than what is claimed for it. I simply say the claims are very large, and to one accustomed to close figuring, startling, even. There are some things said that are too good to be true."

As an addition to what has already been said on the subject of "Chilling Iron," we reproduce the following from "The Tradesman" of August 15:

* * * "In choosing irons for chilling mixtures the experienced man will, if he is to produce a first-class casting, select a comparatively soft iron having a strong chilling tendency, so as to combine strength, close texture and hardness. Hard or white iron is weak. Therefore, in chilled castings it is usually sought to chill only where needed, leaving the remainder of the casting gray in order to strength. Now, if a non-chilling iron, that is to say, an iron having but slight tendency to chill, be used, the pig must be so high in combined carbon in order to produce the required depth of chill, that the result and casting will be weak. Whereas, had a chilling iron, properly so-called, been used, the greatest possible strength might have been secured, together with the required depth of chill.

"I cannot consent to the general proposition that the amount of chill is proportionate to the hardness of the iron used, for, as

between two brands of iron, the softer may chill more deeply than the harder; though, as applied to any one brand of iron, the harder it is the deeper it will chill. Therefore, in selecting metal for chilling mixtures we select for the chilling factor a brand well known to have a strong chilling tendency, rejecting many brands of much harder iron because this tendency is in them slight or wanting. * * *

* * * "And now, if hard iron fuses at a lower temperature than soft, it is, nevertheless, certain that in order to render it equally fluid a much higher temperature is required, and, therefore, at the moment of casting it is hotter than soft iron would be. Therefore, if 'coldness' of the iron at the moment of casting should give the chilling tendency, the very iron which cannot possibly be made to chill, ought to be the best chilling iron!

"Here is the fact as established by practice, viz.: Cast your chill iron so 'cold' that it won't 'run' full, or so intensely hot that it will melt a portion of the chill or iron part of the mold, and in either case a good deep chill will result. Nay, you may even heat the iron part of the mold red hot and then cast white-hot chilling iron upon it, and still the casting will be well chilled, though it will tend to be porous.

"As a matter of fact, the iron part of a chill mold should always, if of large area, be heated before casting, and the iron should be poured as hot as the 'chill' or iron part of the mold will stand."

The waste caused by an unnecessary number of gates on castings, especially small ones, is set forth by Mr. Putnam in an article on "Gate Sticks," from which we take the following:

* * * "The gate stick is of much greater importance in the economies of molding than many people seem to think. It costs something to handle and to melt iron; and if the sprue be twice as large as necessary that element of cost is thereby doubled. Of course, this feature does not count on the 'job floor;' though a good molder on the job floor will always observe proportion so far as convenient in the choice of a gate stick.

"But in these latter days, by far the greater part of the work in the foundry is duplicate work. Here is where competition

crowds hardest, and there are many bright minds looking for a chance to curtail by the merest fraction the cost of production in this branch of founding. Chiefly because in this case the multiplier has so large a multiplier that it is apt to get away with all of your profits if you don't look sharp. Just figure the difference in sectional area between a sprue one inch in diameter and one an inch and a quarter in diameter. Then reflect that this difference is small as compared to the indifference practiced sometimes.

"A gate stick should be as carefully made as any other pattern. Not only should its proportions be carefully adjusted to the size of casting that it is used for, but its finish should be as fine as that of the pattern. A rough, ill-proportioned, unsymmetrical gate stick furnished to a molder carries with it an impression; and I need not say that the impression is not a good one."

IRON MOLDERS' JOURNAL.

R. D. Moore, in an article on "The Pressure of Fluid Iron," says: * * * "The jar given by the explosion of gas under a bottom board immediately after pouring is a cause that has fatally 'strained out' well-clamped molds. The blowing of molds adds greatly to the static pressure of the iron.

"There is a very common practice among molders of hammering a flask when blowing occurs. That is a delusion. The settling at each blow merely shows how much additional strain each blow has given the metal. The exact static, or standing, pressure given on a mold is a considerable fraction over a pound by a 4-inch column, or gate. Careful experiments show it, in a column, or gate, 24 inches high, to be increased from 6 pounds, on a square inch, to 6.4 pounds, or nearly a half pound increase. It may not have suggested itself to many that a bar of iron, any size or shape, if parallel, can be made an instrument for testing the ramming of a mold by setting it on end on the mold. The length should be the height of the gate from the tested surface; should be smooth and carefully set; if a dent is produced in the sand it will be proved too soft-rammed." * * *

From an editorial in this journal on "Co-operation" we abstract the following: * * * "In these days of active compe-

tition ability of another kind than that of mere ability to turn out good castings is required to successfully conduct a foundry business, and the man who possesses that necessary ability is a valuable one, and to retain his services he must be rewarded proportionately to his worth. This, shortsighted co-operators are not always willing to concede, and thus discontent and jealousy are immediately engendered. A co-operative enterprise must be conducted on the same lines, so far as methods are concerned, as any successful private business; otherwise, it is doomed to failure. There is sometimes room for the application of economics that can not be taken advantage of in private concerns, but one of them is not the refusal to pay one, who has the organizing and directing faculty, a good salary." * * *